$$f(x) = \begin{cases} 3-x, & x<1 \\ ax^2+bx, & x \geq 1 \end{cases}$$

$$\lim_{h\to 0^-} \frac{f(1+h)-f(1)}{h} = \lim_{h\to 0^-} \frac{3-(1+h)-(\cancel{a+b})^{2}}{h} = -1$$

$$\lim_{h\to 0^+} \frac{f(1+h)-f(1)}{h} = \lim_{h\to 0^+} \frac{a(1+h)^2+b(1+h)-2}{h}$$

$$= \lim_{h\to 0^+} \frac{a(1+2h+h^2)+b(1+h)-2}{h}$$

$$= \lim_{h\to 0^+} \frac{\cancel{a}+2ah+ah^2+\cancel{b}+bh-\cancel{2}}{h} = \lim_{h\to 0^+} \frac{\cancel{h}(2a+ah+b)}{\cancel{h}} = 2a+b$$

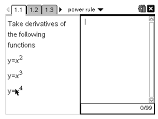
$a+b=2$

$$\begin{array}{r} 2a+b=-1 \\ -\,(a+b=2) \\ \hline a=-3 \\ b=5 \end{array}$$

Sep 15-9:44 AM

3.3a Rules for Differentiation

Use Power Rule.tns to discover the power rule for derivatives



$$\frac{d}{dx} x^n = n\, x^{n-1}$$

$$\boxed{\frac{d}{dx}\, a\cdot x^n = a\cdot n\cdot x^{n-1}}$$

power rule

Sep 11-9:07 PM

Proof of the power rule

Sep 11-9:45 PM

Find $\frac{dy}{dx}$ if $y = x^3 + 6x^2 - \frac{5}{3}x^{1} + 16\cdot x^{0}$

$x^0 = 1$

$y' = 3x^2 + 12x - \frac{5}{3}$

$$\boxed{\frac{d}{dx}(c) = 0}$$

Sep 11-9:45 PM

Find the horizontal tangents of $y = x^4 - 2x^2 + 2$

by hand

$y' = 4x^3 - 4x = 0$

$4x(x^2-1) = 0$

$x = 1 \quad x = 0 \quad x = -1$

$y = 1 \quad y = 2 \quad y = 1$

with the calculator

Sep 11-9:56 PM

higher order derivatives

$y = x^3$

$y' = 3x^2$

$y'' = 6x$

$y''' = 6$

$y^{4} = 0$

$y^{5} = 0$

$\vdots$

0

Sep 11-10:02 PM